भारतीय मानक
Indian Standard

IS 10804 (Part 1) : 2018

कृषि प्रयोजनों के लिए अनुशंसित पम्पिंतग प्रणालियाँ

भाग 1 सतह पम्प

(तीसरा पुनरीक्षण)

Recommended Pumping Systems for Agricultural Purposes

Part 1 Surface Pumps

(Third Revision)

ICS 23.100.10.65

भारतीय मानक ब्यूरो
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Price Group 6

Pump Sectional Committee, MED 20

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pumps Sectional Committee had been approved by the Mechanical Engineering Divisional Council (MEDC).

Indian Standard Recommended Pumping Systems for Agricultural Purposes was first published in 1984 and revised in 1986 and 1994. In this third revision, the standard has been split in two parts. Part 1 is for the Surface Pumps being installed on surface above Water Level. The other part is this series is: IS 10804 (Part 2): Submersible Pump Sets. Standard has been revised to enable the users to select the most efficient pumping system for his requirement taking into account the practical aspects of agricultural pumping. Accordingly, the examples and graphs have been modified.

Further, it was necessary to ensure that selected system is an efficient one, the pump/ pumpset efficiency values has been included for various total heads and flow rates in the form of minimum efficiency charts of IS 6595 and IS 9079.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

RECOMMENDED PUMPING SYSTEMS FOR AGRICULTURAL PURPOSES

PART 1 SURFACE PUMPS

(Third Revision)

1 SCOPE

This standard covers the recommended pumping system for agricultural application consisting of various matching and energy efficient components like centrifugal pump (mono-set or coupled pump set being installed on surface above water level), prime mover (electric motor or diesel/spark ignition engine), suction & delivery pipes, valves (foot/ reflux/bore valve) and pipe fittings.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 RECOMMENDED PUMPING SYSTEM

Different components of pumping system shall conform to the following Indian Standards besides matching with the other components (*see* Fig. 1). Selection of each of the components shall be based on the criteria given against them, so that entire pumping system operates efficiently.

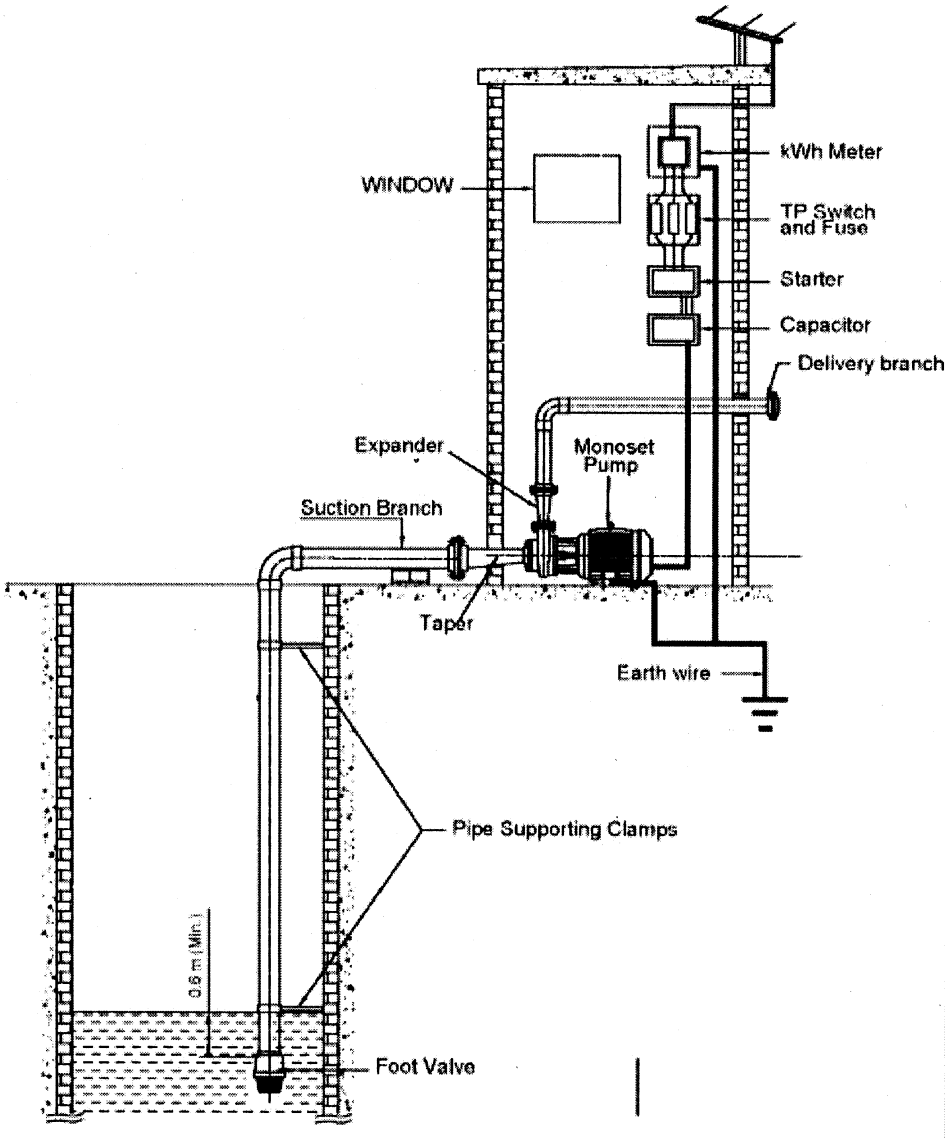
NOTES —

1 An example for selection of pumpset for agricultural requirement is given at Annex B.

2 The flow rate Q at the operating point shall be considered for selecting the pipe size.

3 Due to design considerations and constraints, pump suction and delivery size may not always

Sl. No	*Pumpset*	*Relevant Indian Standards*	*Criteria*
i)	**Centrifugal pump —** Electric or engine coupled	IS 6595 (Part 1)	The pump shall be selected such that it shall operate close - to best efficiency point during peak demand period (Rabi season)
	Electric monoset	IS 9079	
	Engine monoset	IS 11501	
ii)	**Prime mover —** Electric motor	IS 7538	The prime mover rating shall be equal to or more than the power consumption in the entire operating range
	Spark ignition engine	IS 7347	
	Compression ignition engine	IS 11170	
iii)	Suction and delivery pipes or piping system	IS 1239 (Part 1)	The size of pipes shall be selected in such a way that the friction losses shall not exceed 10 percent of total length of pipe. Data given in Tables 1, 2, 3 and 4 shall used to select proper size of pipes
		IS 4984	
		IS 4985	
		IS 12231	
iv)	Foot valve or reflux valve or bore valve	IS 10805	Size of valve shall be equal to the size of suction pipe
v)	Pipe fittings (bends)	IS 1239(Part 2)	The size of bends and other fittings shall be matching with the sizes of GI pipes, HDPE pipes or RPVC pipes to be used in piping systems.
		IS 13593	
		IS 10124(Part 8)	
vi)	Tapers /Expanders	IS 14263	The size of the eccentric tapers for suction side and size of the concentric tapers for the delivery side shall be selected suitable to the recommended pipe sizes based on the pump flow rate Q at the duty point.



Note — It is desirable to use non-return valve on delivery side, if the total head is more than 25m.

FIG. 1 TYPICAL INSTALATION HORIZONTAL CENTRIFUGAL PUMP

match with the recommended pipe size. In such cases, suitable tapers /expanders shall be used as per IS 14263 between pump and pipes to fit therecommended pipe sizes.

4 COMPUTATION OF FLOW RATE 'Q' & TOTAL HEAD 'H'

4.1 The Flow rate (Discharge rate) Q of water required shall be determined as per the guidelines given in IS 9694 (Part 1), however it shall not exceed the Yield of the well/water source. In case, yield is less, operating hours of the pumpset shall be increased to match the yield.

4.2 Based on the flow rate of water required and material of pipe, the suction and delivery pipe size shall be selected from Table 1, 2, 3 and 4 to limit the friction losses in pipes to 10% maximum. In case, water is to be delivered to a long distance, friction losses in offset pipe may have to be limited to much lower value (may be as low as 0.5 to 1 % depending on the length) to limit the Total Head and thus to limit the prime- mover rating and thereby Energy Bill. Thus in such cases larger size offset pipes to be selected depending on Cost Economics.

4.2 The length of piping required shall be determined from the static head (water level to delivery point straight height). This shall be increased by minimum one metre required for the submergence of the foot valve below the water to avoid air entrainment. The offset lengths of pipes from well to pump & pump to delivery

point are to be further added to arrive at total pipe length.

4.3 The friction losses in the pipes shall be computed for the pipe length based on flow rate (Q) and pipe size [refer Tables 5(A), 5(B) and 5(C)].

4.4 Friction losses in foot valve will be 0.8 times suction velocity head (refer Tables 5(A), 5(B) and 5(C) for values of velocity head).

4.5 Total head 'H' shall be calculated by adding static head (hst), losses in pipes and foot valve (hfs) and discharge velocity head. This should be further corrected by adding friction losses in additional pipe fittings and valves if any. Total head 'H' is to be calculated considering static head (hst) during Rabi season since the pumping required during this period is normally maximum in the entire year.

H = hst + hfs + discharge velocity head

4.6 Based on the flow rate at duty point of the selected pump,suction and delivery pipe sizes shall be selected and suitable tapers for suction and delivery lines also to be selected as per IS 14263.

4.7 The total pumping system friction losses to be maximum 10 percent.

5 SELECTION OF PUMPING SYSTEM (*See* ANNEX B)

5.1 Calculate the flow rate 'Q' required as explained in **4.1**.

5.2 Choose pipe material depending on installation requirement and select suitable size of suction, delivery and offset pipes as explained in **4.2**.

5.3 Select foot valve as per the size of suction pipe and with '*K*' factor less than or equal to 0.8.

5.4 Estimate total head '*H*' required as explained in **4.6**.

5.5 Choose the type of pumpset to be used i.e. an electric monoset, a motor coupled pumpset or an engine coupled pumpset or engine monoset.

5.6 Select suitable pump based on computed H & Q. Pump selected shall be such that the operating point lies close to the best efficiency point (BEP) on the pump characteristics during rabi season as computed in **4.6**, which is the most irrigating period. However its maximum head shall be such that it is capable to discharge during summer season also. If irrigation requirement is large during summer also, it is recommended to select separate pumpset for summer, operating close to BEP during this season which will ensure efficient operation during the entire year.

5.7 Prime-mover Rating — In a monoset pump, prime-mover will be an integral part of pumpset, however in case of coupled set, a separate prime-mover is to be selected with such rating that it does not get overloaded in the entire operating head range. Prime-mover of rating more than required shall not be selected as prime-mover operates inefficiently when underloaded. This criterion shall also be applied to check whether provided rating of monoset prime-mover is correct or not.

5.7.1 Maximum power consumption shall be worked out as per annex B for selection of suitable prime mover.

5.8 All the above components shall conform to relevant Indian Standards referred in **2**.

6 EFFICIENCY

6.1 The minimum efficiency of coupled pump (only pump unit) at the specified duty point shall be in accordance with Fig. 1 and 2 for speeds 1 200 to 2 000 rpm and in accordance with Fig. 3 and 4 for speeds 2 001 to 3 600 rpm given in IS 6595 (Part 1).

6.2 The minimum overall efficiency of monoset pumps at the specified duty point shall be in accordance with Fig. 3 and 4 for 2 pole and Fig. 5 and 6 for 4 pole monoset pumps as given in IS 9079.

Table 1 Permissible Ranges of Volume Rates of Flow in l/s Through Galvanized Steel Pipes to Limit Friction Losses to 10 Percent of the Pipe Length (IS 1239, C = 140)

Sl. No.	Grade Nominal Size	Light Rate of Flow	Medium Rate of Flow	Heavy Rate of Flow
	mm	l/s	l/s	l/s
(1)	(2)	(3)	(4)	(5)
i)	40	1.90 – 2.74	1.79 – 2.67	1.59 – 2.41
ii)	50	2.74 – 5.24	2.67 – 4.95	2.41 – 4.54
iii)	65	5.24 – 9.97	4.95 – 9.80	4.54 – 9.17
iv)	80	9.97 – 15.54	9.80 – 14.97	9.17 – 14.20
v)	100	15.54 – 30.84	14.97 – 30.00	14.20 – 28.67
vi)	125	—	30.00 – 52.50	28.67 – 51.37
vii)	150	—	52.50 – 84.18	51.37 – 82.63

Table 2 Permissible Ranges of Volume Rates of Flow in l/s Through RPVC Pipes Limit Friction Losses to 10 Percent of the Pipe Length (IS 4985, C = 150)

Sl. No.	Grade Nominal Size	Class 1 (0.25 MPa) Rate of Flow	Class 2 (0.4 MPa) Rate of Flow	Class 3 (0.6 MPa) Rate of Flow
	mm	l/s	l/s	l/s
(1)	(2)	(3)	(4)	(5)
i)	40	–	–	Up to 2.04
ii)	50	–	–	2.04 – 3.70
iii)	63	–	3.80 – 7.24	3.70 – 6.77
iv)	75	–	7.24 – 11.47	6.77 – 10.76
v)	90	11.50 – 19.58	11.47 – 18.59	10.76 – 17.41
vi)	110	19.58 – 33.25	18.59 – 31.71	17.41 – 29.75
vii)	125	33.25 – 46.63	31.71 – 44.33	29.75 – 41.44
viii)	140	46.63 – 62.92	44.33 – 59.79	41.44 – 55.97
ix)	160	62.92 – 89.28	59.79 – 84.95	55.97 – 79.76

Table 3 Permissible Ranges of Volume Rates of Flow in l/s Through HDPE Pipes to Limit Friction Losses to 10 Percent of the Pipe Length (IS 4984, C = 150)

Sl. No.	Grade Nominal Size	Class PN 2.5 Rate of Flow	Class PN 4 Rate of Flow	Class PN 6 Rate of Flow
	mm	l/s	l/s	l/s
(1)	(2)	(3)	(4)	(5)
i)	40	–	Up to 1.87	Up to 2.04
ii)	50	–	1.87 – 3.40	1.62 – 2.92
iii)	63	3.40 – 6.92	3.40 – 6.29	2.92 – 5.40
iv)	75	6.92 – 11.01	6.29 – 9.86	5.40 – 8.59
v)	90	11.01 – 17.80	9.86 – 15.96	8.59 – 13.86
vi)	110	17.80 – 30.21	15.96 – 27.65	13.86 – 23.60
vii)	125	30.21 – 42.30	27.65 – 38.23	23.60- 33.00
viii)	140	42.30 – 57.11	38.23 – 51.33	33.00 – 44.63
ix)	160	57.11 – 81.33	51.33 – 72.89	44.63 – 63.41

Table 4 Permissible Ranges of Volume Rates of Flow in l/s Through Unplasticized RPVC Pipes to Limit Friction Losses to 10 Percent of the Pipe Length (IS 12231, C = 150)

Sl. No.	Grade Nominal Size	Type 1 W (0.4 MPA) Rate of Flow	Type 2 W (0.6 MPA) Rate of Flow
	mm	l/s	l/s
(1)	(2)	(3)	(4)
i)	63	3.80 – 7.24	3.70 – 6.77
ii)	75	7.24 – 11.47	6.77 – 10.76
iii)	90	11.47 – 18.59	10.76 – 17.41
iv)	110	18.59 – 31.71	17.41 – 29.75
v)	140	44.33 – 59.79	41.44 – 55.97

Table 5 (A) Frictional Losses in Metres per 100 Metre Pipe Length and Velocity Head in Meters
(New G.I. Pipe of Medium Series) *(See Fig. 2)*

Sl. No.	Nominal Pipe Size mm	50		65		80		100		125		150	
	Inside Dia mm	52.95		68.65		80.65		105.05		129.95		155.5	
	Discharge l/s	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
i)	2	1.87	0.04										
ii)	3	3.95	0.09										
iii)	4	6.73	0.17										
iv)	5	10.18	0.26										
v)	6			4.03	0.13								
vi)	7			5.36	0.18								
vii)	8			6.86	0.24								
viii)	9			8.54	0.30								
ix)	10			10.38	0.37								
x)	11					5.65	0.24						
xi)	12					6.64	0.28						
xii)	13					7.70	0.33						
xiii)	14					8.83	0.38						
xiv)	15					10.03	0.44						
xv)	16							3.12	0.17				
xvi)	20							4.72	0.27				
xvii)	24							6.61	0.39				
xviii)	28							8.80	0.53				
xix)	32							11.27	0 .69	4.00	0.30		
xx)	36									4.97	0.38		
xxi)	40									6.05	0.46		
xxii)	44									7.21	0.56		
xxiii)	48									8.47	0.67		
xxiv)	52									9.83	0.78		
xxv)	55									10.90	0.88	4.55	0.43
xvi)	60											5.34	0.51
xvii)	65											6.20	0.60
xviii)	70											7.11	0.69
xxix)	75											8.08	0.79
xxx)	80											9.11	0.90
xxxi)	85											10.19	1.02

F.L: Friction loss in meteres in 100 metres pipe length V.H.: Velocity Head in metres

Table 5 (B) Frictional Losses in Metres per 100 Metre Pipe Length and Velocity Head in Meters
(RPVC Pipe of Class 3) *(See Fig. 3)*

Sl. No.	Nominal Pipe Size mm	40		63		75		90		110		125		140		160	
	Inside Dia mm	36.8		58.1		69.3		83.2		102		115.7		129.7		148.4	
	Discharge l/s	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
i)	1	2.68	0.05														
ii)	2	9.66	0.18														
iii)	4			3.77	0.12												
iv)	5			5.70	0.18												
v)	6			7.99	0.26												
vi)	7			10.63	0.36												
vii)	8					5.77	0.23										
viii)	9					7.18	0.29										
ix)	10					8.72	0.36										
x)	11					10.41	0.43										
xi)	12							5.02	0.25								
xii)	14							6.68	0.34								
xiii)	16							8.55	0.44								
xiv)	18							10.64	0.56								
xv)	20									4.79	0.31						
xvi)	22									5.72	0.37						
xvii)	24									6.72	0.44						
xviii)	26									7.79	0.52						
xix)	28									8.94	0.60						
xx)	30									10.16	0.69						
xxi)	32											6.20	0.47				
xxii)	34											6.93	0.53				
xxiii)	36											7.71	0.60				
xxiv)	38											8.52	0.67				
xxv)	40											9.37	0.74				
xxvi)	42											10.25	0.81	5.88	0.52		
xvii)	44													6.41	0.57		
xviii)	48													7.53	0.67		
xix)	52													8.73	0.79		
xxx)	56													10.01	0.92		
xxxi)	60															5.91	0.61
xxxii)	64															6.66	0.70
xxxiii)	68															7.45	0.79
xxxiv)	72															8.28	0.88
xxxv)	76															9.15	0.98
xxxvi)	80															10.06	1.09

F.L. : Friction loss in meters in 100 meters pipe length V.H. : Velocity Head in meters

Table 5 (C) FRICTIONAL LOSSES IN METRES PER 100 METRE PIPE LENGTH AND VELOCITY HEAD IN METERS

(HDPE PIPE OF CLASS PN 4)

Sl. No.	Nominal Pipe Size mm	50		63		75		90		110		125		140		160	
	Inside Dia mm	44.7		56.5		67.1		80.5		99.2		112.2		125.5		143.4	
	Discharge l/s	F.L	V.	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H	F.L	V.H
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
i)	1	1.04	0.02														
ii)	2	3.75	0.08														
iii)	3	7.94	0.19														
iv)	4	13.5	0.33	4.32	0.13												
v)	5			6.53	0.20												
vi)	6			9.16	0.29												
vii)	7			12.18	0.40	5.27	0.20										
viii)	8					6.75	0.26										
ix)	9					8.40	0.33										
x)	10					10.21	0.41										
xi)	11							5.02	0.24								
xii)	12							5.89	0.28								
xiii)	13							6.84	0.33								
xiv)	14							7.84	0.39								
xv)	15							8.91	0.44								
xvi)	16							10.04	0.50								
xvii)	18									4.52	0.28						
xviii)	20									5.49	0.34						
xix)	22									6.55	0.41						
xx)	24									7.69	0.49						
xxi)	26									8.92	0.58						
xxii)	28									10.24	0.67						
xxiii)	30											6.39	0.47				
xxiv)	32											7.20	0.53				
xxv)	34											8.05	0.60				
xxvi)	36											8.95	0.68				
xxvii)	38											9.89	0.75				
xxviii)	40											10.88	0.83				
xxix)	42													6.90	0.59		
xxx)	44													7.52	0.64		
xxxi)	46													8.17	0.70		
xxxii)	48													8.84	0.77		
xxxiii)	50													9.53	0.83		
xxxiv)	52													10.25	0.90		
xxxv)	56															6.14	0.61
xxxvi)	60															6.98	0.70
	64															7.86	0.80
xxxvii)	68															8.80	0.90
xxxviii)	72															9.78	1.01
xxxix)	76															10.81	1.13

F.L. : Friction loss in meteres in 100 metres pipe length V.H. : Velocity Head in metres

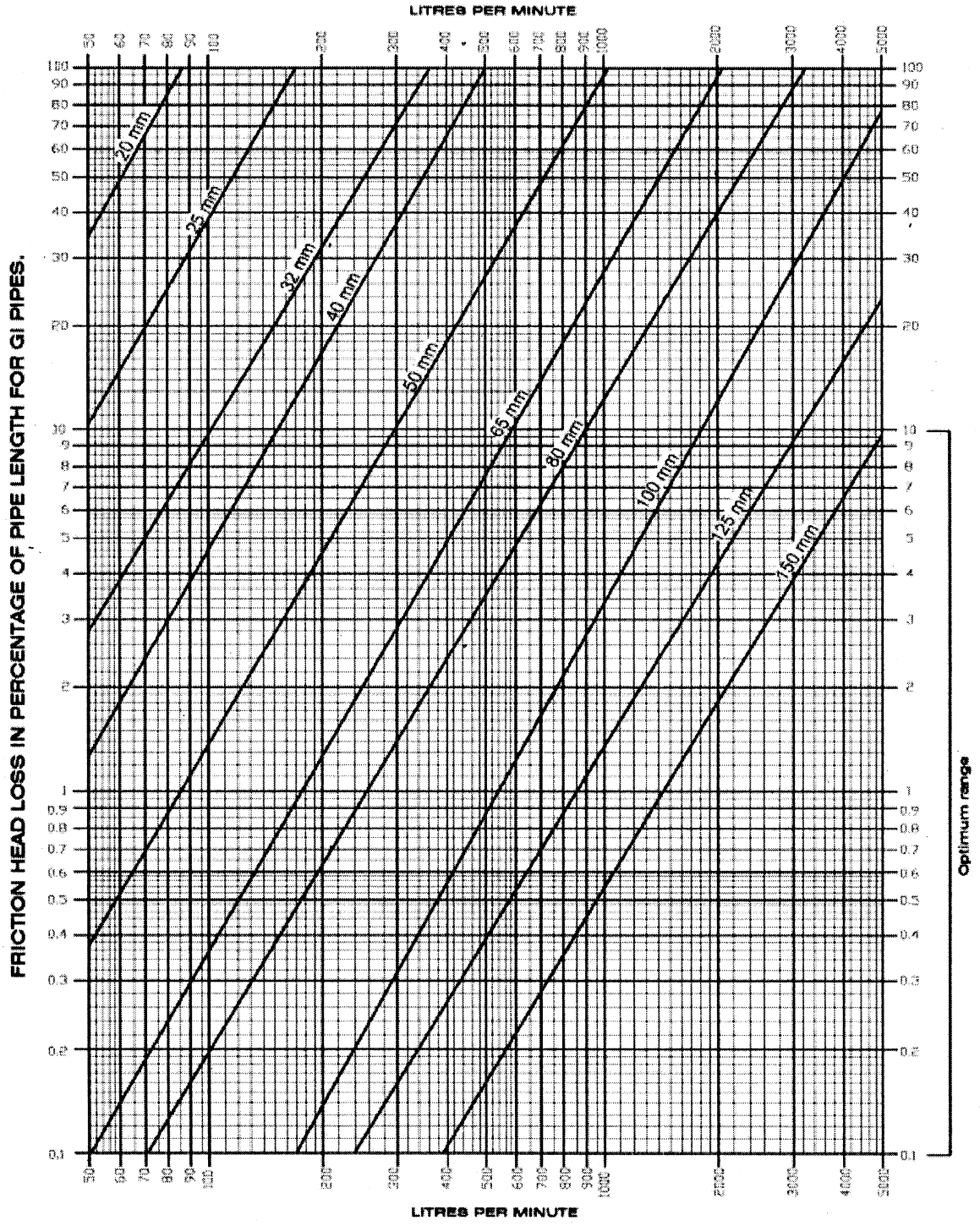


FIG. 2 FRICTION HEAD LOSS FOR GI PIPES (MEDIUM SERIES)

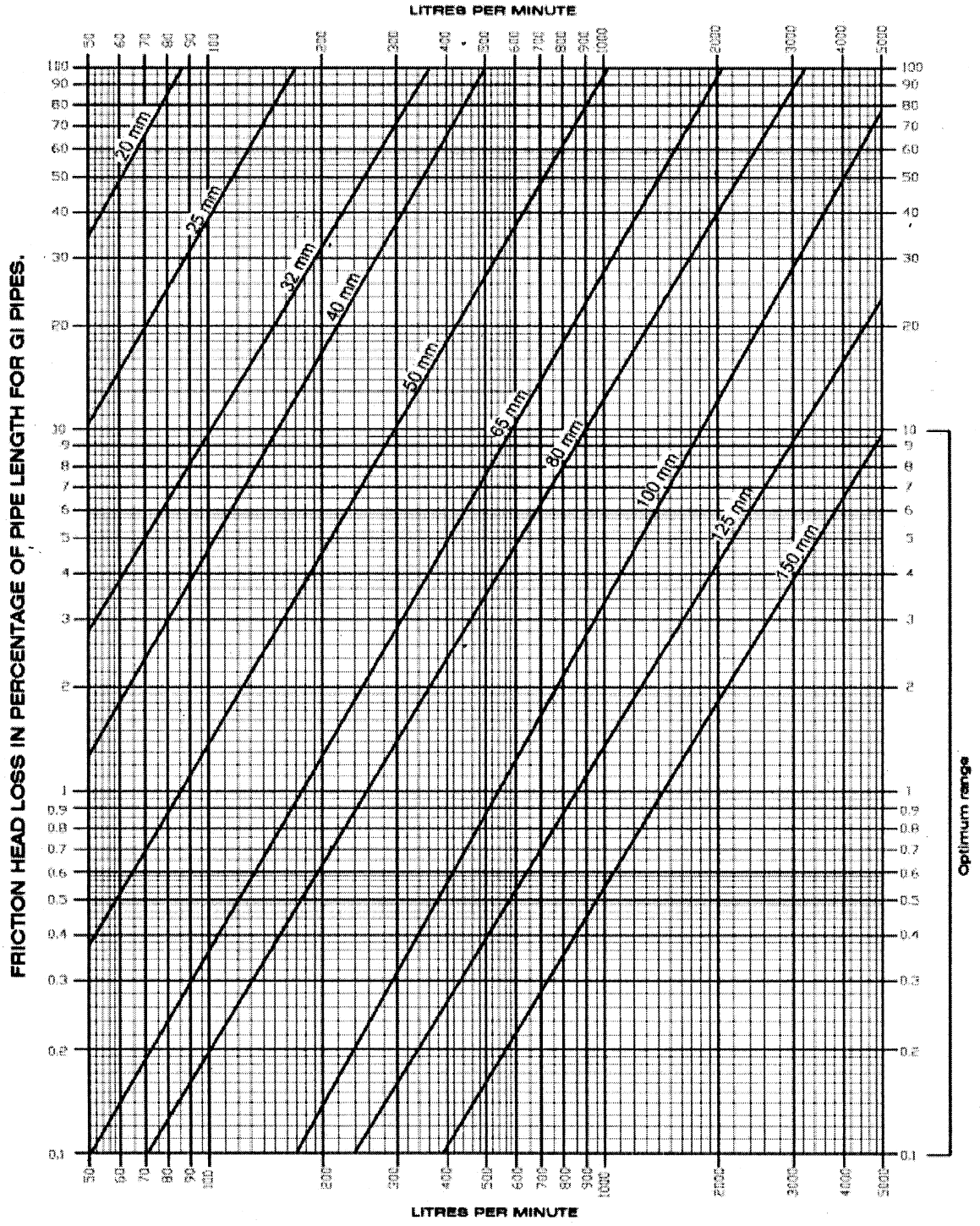


FIG. 3 FRICTION HEAD LOSS FOR RIGID PVC PIPES (CLASS 3,6 kg/cm²)

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
1239	Steel tubes, tubulars and other wrought steel fittings:
(Part 1) : 2004	Steel tubes (*sixth revision*)
(Part 2) : 201	Steel pipe fittings (*fifth revision*)
4984 : 1995	Specification for high density polyethylene pipes for water supply, (*fourth revision*)
4985 : 2000	Specification for unplasticised PVC pipes for potable water supplies (*third revision*)
6595 (Part 1) : 2002	Horizontal centrifugal pumps for clear, cold water: Part 1 Agricultural and rural water supply purposes (*third revision*)
7347 : 1974	Performance of small size spark ignition engines for agricultural sprayers and similar applications
7538 : 1996	Specification for three phase squirrel cage induction motors for centrifugal pumps for agricultural applications (*first revision*)
9079 : 2002	Electric monoset pumps for clear, cold water for agricultural and water supply purposes (*second revision*)
9694 (Part 1) : 1987	Code of practice for the selection, installation, operation and maintenance of horizontal centrifugal pumps for agricultural applications : Part 1: Selection (*first revision*)
10124 (Part 8) : 2009	Specification for fabricated PVC-U fittings for potablewater : Part 8 Specific requirements for 90 degree bends (*second revision*)
10805 : 1986	Foot valves, reflux valves or non-return valves and bore valves to be used in suction lines of agricultural pumping systems (*first revision*)
11170 : 1985	Performance requirements for constant speed compression ignition (diesel) engines for agricultural purposes (up to 20 kW)
11346 : 2002	Tests for agricultural and water supply pumps — Code of acceptance (*first revision*)
11501 : 1986	Specification for engine monoset pumps for clear, cold, waterfor agricultural purposes
12231 : 1987	Specification for unplasticized PVC pipes for use in suction and delivery lines of agricultural pumpsets
13593 : 1992	UPVC pipe fittings for use with UPVC pipes in the suction and delivery lines of agricultural pumps — Specification
14263 : 1995	Tapers for agricultural pumping systems

ANNEX B

(*Clause* 3)

EXAMPLE FOR SELECTION OF PUMPING SYSTEMS FOR AGRICULTURAL REQUIREMENT

B-1 A TYPICAL EXAMPLE IS GIVEN BELOW FOR SELECTION OF A MONOSET

Installation Details

B-1.1 Suction branch

Height of pump centre line from water level : 4 m

Submergence of foot valve : 1.5 m

Offset pipe length : 5 m

One bend

One foot valve

B-1.1.1 Delivery branch

Height of delivery point from pump centre line : 7 m

Offset pipe length : 70 m

One bend :

Area to be irrigated : 5 ha

Crop : Rice

B-2 ESTIMATION OF FLOW RATE FOR IRRIGATION

It is required to determine the flow rate (Q) to irrigate a piece of land of 5 ha area for rice cultivation.

The various parameters as applicable are given below:

Area to be irrigated = 5 ha

Interval of irrigation for rice crop = 7 days

Depth of irrigation for rice crop = 75 mm

Hence, area to be irrigated per day = 5/7 = 0.71 ha

The volume rate of flow required to irrigate 0.71 ha per day (12 hours of pumping)

$$= \frac{0.71 \times 10000 \times 0.075}{12} \text{ m}^3/\text{h}$$

$$= 44.64 \text{ m}^3/\text{h}$$

To allow for conveyance losses of water flowing from the pump to the field, multiply the volume rate of flow by 1.1.

Flow rate (Q) required = 44.64 × 1.1

= 49.1 m^3/h

= 13.64 l/s

B-2.1 Selection of pipe size:

It was decided to use new G.I. pipe of medium series. For selecting galvanized steel pipe for a flow rate of 13.64 l/s refer Table 1. The nominal pipe size for medium class is 80 mm. Hence, suction pipe of 80mm and delivery pipe of 80 mm shall be used.

B-3 COMPUTATION OF TOTAL HEAD

Static head considered for the system (m)

= 4 + 7 = 11 m

Total equivalent pipe length to be considered for

= Length equal to Static head + submergence + friction losses + Offset length + pipelength equivalent to 2 bends

= (4+7)+1.5+(5+70)+(2×2)

= 91.5 m

While we refer the Table 5 (A), frictional losses are given for 13 and 14 l/s flow rate. Hence, for flow rate 13.64 l/s, we can interpolate the frictional losses as 8.4 m per 100 m pipe length.

Hence, friction losses in pipe length

= 91.5 × 8.4/100

= 7.69 m

Losses in foot valve = 0.8 × suction velocity head

Refer Table 5(A) for determining velocity head for 80 mm GI medium series pipe. For 13 l/s and 14 l/s flow rate, velocity head is 0.33 and 0.38 respectively. For 13.64 l/s discharge, we can take a value of 0.36.

Losses in foot valve = 0.8 × 0.36

= 0.29 m

Hence, Total head = static head + friction loss in piping + friction loss in footvalve + discharge velocity head

= 11 + 7.69 + 0.29 + 0.36

= 19.34 m say 19.3 m

B-4 MAXIMUM PRIME MOVER RATING OF MONOSET

Decided to use monoset with 4 pole motor (around 1 450 rpm). For flow rate 13.64 lps and total head 19.3 m, read the minimum efficiency from Fig. 6 of IS 9079

Minimum pump efficiency : 66 percent

Duty point power (BPkW) : 3.91 kW
Power in entire range of head (BPkW) : 4.69 kW
(considering 20% margin)
Hence, recommended prime mover rating : 5.5. kW

B-5 PUMP AND PIPING SYSTEM SPECIFICATIONS

Pump set and pumping system details for this typical irrigation requirement are:

a) Monoset pump as per IS 9079
   Total head (H) = 19.3 m
   Volume rate of flow (Q) = 13.64 l/s
   Motor rating (P) Max = 5.5 kW
b) Prime mover : Since mono set pump is selected, no separate prime mover is required.
c) Piping system
   Foot valve as per IS 10805 80 mm
   Straight galvanized pipe 80mm size 87.5 m
   Long radius bends 80 mm size 2 Nos.

B-6 SELECTION OF PUMPING SYSTEM (ALTERNATIVE SYSTEM)

B-6.1 Selection of Pipe Size

Since there is long offset pipe length of 70 m, it is recommended to reduce the friction losses in the offset pipe length. 100mm pipe can be used in the offset length with an expander. Friction losses will reduce from 8.4% to 2.3% in this length.

B-7 COMPUTATION OF TOTAL HEAD

Now, 70 m pipe length will be of 100 mm size and 21.5 m equivalent pipe length will be of 80 mm size. Frictional losses in total pipe length

$$= \frac{2.3 \times 70}{100} + \frac{8.4 \times 21.5}{100}$$

$$= 1.61 + 1.81 = 3.42 \text{ m}$$

Losses in expander = 0.36 m

Total head (H) = Static head + frictional losses + Losses in expander + Losses in Foot-valve + Velocity head

= 11 + 3.42 + 0.36 + 0.29 + 0.12

= 15.19 m say 15.2 m

B- 8 MAXIMUM PRIME MOVER RATING OF MONOSET

Decided to use monoset with 4 pole motor (around 1450 rpm). For flow rate 13.64 lps and total head 15.2 m, read the minimum efficiency from Fig. 6 of IS 9079

Minimum pump efficiency : 68 percent
Duty point power (BPkW) : 2.99 kW
Power in entire range of head (BPkW) : 3.59 kW
(considering 20% margin)
Hence, recommended prime mover rating : 3.7 kW

Thus, if we go for alternative system, we invest little more in higher size offset pipe length from 80 mm to 100 mm, however, prime mover rating is reduced from 5.5 kW to 3.7 kW; and this will result in reduced operating cost, which will be a recurring saving.

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